AMENDMENT TO THE SPECIFICATION

[0010] In particular, an integrated optical chip device ~~is~~ usable for molecular diagnostics in what we term a tunable laser cavity sensor (TLCS) is flip chip bonded to a microfluidic chip. The TLCS is formed from a reference laser and a sensor laser, each comprising a waveguide having a gain section, a partially transmissive mirror section, and a coherent light beam output section, one or both of the waveguides having a phase control section. The light beam output sections of the reference and sensor lasers are joined to enable the coherent light from these sections to interfere, providing a heterodyned frequency. The sensor laser has a thinned waveguide region exposing evanescent field material to form a cavity and which detects the presence of a molecule by a heterodyned frequency shift.

[0031] As shown, the frequency output of the sensor waveguide differs by $\pm\Delta\lambda$ from the frequency of their reference waveguide. By adjusting the tuning electrodes as shown in Figure 2, one can enhance the measurement resolution by tuning to possible molecular bond resonances, e.g. in the 1550 nm wavelength range. Researchers at the University of California in Santa Barbara have pioneered DBR lasers with extended tuning ranges–so called sampled grating-DBR lasers. The lasing wavelengths of these lasers can be tuned up to 100 nm, enabling the measurement of the index of the perturbing species versus wavelength over a relatively wide range to better identify their chemical nature.

[0037] Put another way, again assuming the index shift in the small perturbation region, ns = 0.1, the net fill-factor of this region relative to the volume of the guided mode can be as small as □xy□z, = (10MHz)(3.3)/(0.1)(193THz) = 1.7 x 10^6. Then, for example, if the transverse over lap, □xy is only 0.1% (very conservative estimate of the evanescent field), the axial □z can be as small as 0.17%. Therefore, with a net laser cavity length of 500 μm, single submicron particles can be detected. ~~[Please review the~~

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~~above formula and calculations, many were reported differently in the previously filed invention].~~